IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VoiceAge EVS LLC, a Delaware limited liability company, Plaintiff, v. Apple Inc., Defendant.	Case No. _____ **DEMAND FOR JURY TRIAL**

COMPLAINT FOR PATENT INFRINGEMENT

VoiceAge EVS LLC ("VoiceAge EVS" or "Plaintiff") brings this action for patent infringement under 35 U.S.C. § 271 against Apple Inc. ("Apple" or "Defendant"), and alleges as follows:

INTRODUCTION

1. This action involves foundational patented audio coding technology developed by VoiceAge Corporation now owned by VoiceAge EVS LLC. VoiceAge Corporation and VoiceAge EVS LLC are independent companies. VoiceAge Corporation is the world's premier supplier of speech and audio codecs. Since its creation in 1999 by professors and scientists at the Université de Sherbrooke, VoiceAge Corporation has been at the center of pioneering speech and audio technology.

2. Through its work, VoiceAge Corporation developed world-leading technology for wideband, super wideband, and fullband low bit rate speech and

audio compression technologies. VoiceAge Corporation provided the core technologies for at least nine internationally standardized voice and audio codecs for both wireless and wired applications. All standardization organizations to which VoiceAge has proposed its patented technology over the past two decades have preferred VoiceAge technologies over other technologies. These include the 3rd Generation Partnership Project ("3GPP"), 3GPP2, the International Telecommunications Union ("ITU"), the European Telecommunications Standards Institute ("ETSI") and the Motion Picture Experts Group ("MPEG") of the International Organization for Standardization ("ISO").

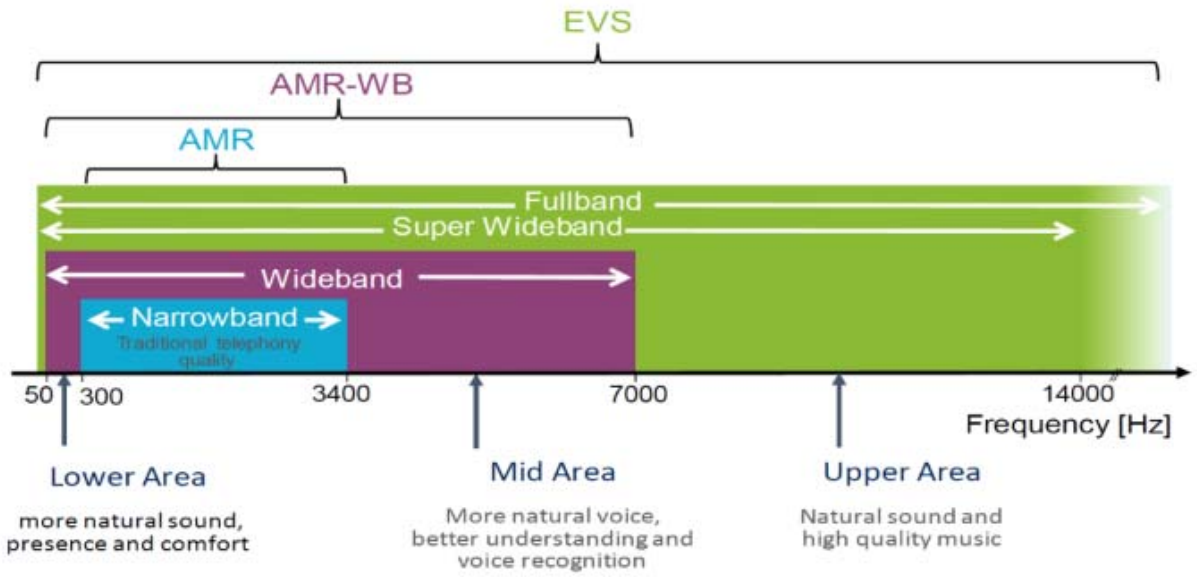
3. One technology that VoiceAge Corporation developed, alongside others, is the Enhanced Voice Services ("EVS") codec. VoiceAge Corporation was a key contributor to the development of the EVS codec and its adoption by 3GPP as the next generation speech and audio codec standard for wireless communications.

4. The EVS codec was designed for the Fourth Generation mobile communications standard (otherwise known as the "4G" or Long-Term Evolution—"LTE" standard). In particular, the EVS codec was designed for use with Voice over LTE ("VoLTE") services. The patents at issue in this matter are generally drawn to the EVS codec.

5. The EVS codec employs cutting-edge technology to significantly enhance the communication quality, efficiency, and versatility of 3GPP mobile communication systems. The EVS codec is rapidly replacing the Adaptive Multirate Wideband ("AMR-WB") codec (also based on VoiceAge Corporation's work) as the leading standard for speech and audio coding on wireless networks. Among the many benefits over AMR-WB, EVS provides full-HD voice audio quality, higher efficiency and versatility, and increased reliability to consumers.

6. The delivery of unprecedented quality for speech, background music (when appropriate), and mixed content through the EVS codec is the result of a number of technical advantages and improvements over AMR-WB. For example, where AMR-WB was limited to wideband, the EVS codec allows audio signals to be encoded in narrowband ("NB"), wideband ("WB"), super wideband ("SWB"), or fullband ("FB"). The EVS codec also: allows the use of variable bit rates across a wide range of bit rates from 5.6 kb/s to 128 kb/s, allowing service providers to optimize network capacity and call quality as desired for their service; improves compression efficiency at all operational rates; provides the capability to switch bit rates at every 20-ms frame, allowing the codec to easily adapt to changes in channel capacity; incorporates unique concealment techniques to minimize the impact of packet loss caused by adverse conditions in the transmission channel; includes a system for Jitter Buffer Management ("JBM"); and uses different coding strategies depending on the characteristics of the signals to be transmitted.

7. Compared to AMR-WB, EVS more than doubles the spectral bandwidth available to encode sound signals, resulting in unprecedented quality voice transmission and the transfer of high-quality non-vocal audio such as music:



8. Independent studies have shown that EVS outperforms AMR-WB at all operational points, providing much higher quality sound using fewer bits than AMR-WB.

9. Through these and other technical advantages, EVS (sometimes referred to commercially as "Enhanced HD Voice," "Ultra HD Voice," or "HD Voice+") provides a high efficiency and versatile solution to audio and speech encoding. Consumers therefore enjoy, for example: better sounding, clearer calls; smoother conferencing; and a "being-there" quality of experience.

10. In 2016, T-Mobile became the first wireless carrier in the United States to upgrade its network to support EVS, touting EVS as "a true next-gen voice technology that delivers some incredibly cool benefits to our customers," including "improv[ing] voice call reliability in areas of weaker signal" and "even higher-fidelity calls."[1] On information and belief, Verizon Wireless also upgraded its network to support EVS.[2] The 3GPP "anticipate[s] that enhanced voice services based on the new EVS codec will become the dominant voice service in 3GPP LTE networks."[3]

11. Through its research and development efforts, VoiceAge Corporation was awarded a number of patents directed to the EVS codec. These patent assets,

[1] Neville Ray, *Patent-Pending: T-Mobile's Next Network Upgrade with Enhanced Voice Services*, T-MOBILE (Apr. 5, 2016), https://www.t-mobile.com/news/volte-enhanced-voice-services.

[2] *See, e.g.*, Sascha Segan, *How to Make Your Cell Phone Calls Sound Better*, PCMAG (Apr. 13, 2018), https://www.pcmag.com/article/360357/how-to-make-your-cell-phone-calls-sound-better.

[3] 3GPP TR 26.952 V16.1.0 (2019-06).

including all patents asserted in this Complaint, were assigned and/or exclusively licensed to VoiceAge EVS.

12. As further evidence of the value of VoiceAge Corporation's inventions, numerous mobile device and communications companies have taken licenses to these patents, including all patents asserted in this Complaint, both before and after the assignment of patent rights from VoiceAge Corporation to VoiceAge EVS.

NATURE OF THE ACTION

13. This complaint alleges patent infringement. VoiceAge EVS alleges that Apple has infringed and continues to infringe, directly and/or indirectly, five VoiceAge EVS patents: U.S. Patent Nos. 7,693,710 (the "'710 patent"), 8,401,843 (the "'843 patent"), 8,990,073 (the "'073 patent"), 8,825,475, (the "'475 patent"), and 9,852,741 (the "'741 patent"), copies of which are attached as Exhibits 1-5 (collectively, the "VoiceAge Patents").

14. The VoiceAge Patents cover foundational audio coding technologies for the EVS codec. These technologies are necessary for Apple's consumers to enjoy Enhanced HD Voice, Ultra HD Voice, or HD Voice+ services when using Apple's mobile devices. The VoiceAge Patents disclose technologies that enable many consumer benefits including better sounding, clearer calls and smoother conferencing, when compared to older technologies operating at the same bit rate.

15. Apple directly infringes the VoiceAge Patents by making, using, offering to sell, selling, and/or importing into the United States mobile devices that practice the inventions claimed in the VoiceAge Patents.

16. Apple indirectly infringes the VoiceAge Patents by inducing its consumer end-users to directly infringe the VoiceAge Patents. Apple induces infringement by providing mobile devices that, when used by consumers for voice calls or conferencing using EVS technology, as directed and intended by Apple,

cause those users to make, use, and practice the inventions claimed in the VoiceAge Patents.

17. VoiceAge EVS seeks damages and other relief for Apple's infringement of the VoiceAge Patents.

THE PARTIES

18. VoiceAge EVS is a Delaware limited liability company. Its principal place of business is 620 Newport Center Drive, Suite 1100, Newport Beach, CA 92660. VoiceAge EVS owns patents covering foundational voice coding technologies, including those asserted here.

19. Defendant Apple is a California corporation with its principal place at One Apple Park Way, Cupertino, California 95014. Apple designs, manufactures, and markets mobile communication and media devices. Apple makes, uses, sells, offers for sale, and/or imports throughout the United States, including this District, products, such as mobile devices, that infringe the Asserted Patents.

JURISDICTION AND VENUE

20. This is an action for patent infringement under the Patent Laws of the United States, 35 U.S.C. § 1 et seq., over which this Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

21. This Court has both general and specific jurisdiction over Apple because Apple has committed acts within this District giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over Apple would not offend traditional notions of fair play and substantial justice. Apple, directly and through subsidiaries and intermediaries (including distributors, retailers, franchisees and others), has committed and continues to commit acts of patent infringement in this District, by, among other things, making, using, testing, selling, licensing, importing and/or offering for sale/license products and services that infringe the VoiceAge Patents.

22. Venue is proper in this District under 28 U.S.C. §§ 1391(b)-(d) and 1400(b). Defendant Apple has a regular and established place of business in this District, is subject to personal jurisdiction in this District, regularly conducts business in this District, and has committed and continues to commit acts of direct and indirect patent infringement in this District.

23. Defendant Apple has employees and operates a retail store at 125 Christiana Mall, Newark, DE 19702. *See* https://www.apple.com/retail/christianamall/ (last visited Aug. 11, 2020); https://www.christianamall.com/en/directory/apple-8718.html (last visited Aug. 11, 2020). Defendant Apple's retail store at 125 Christiana Mall sells and offers for sale products and services that infringe the VoiceAge Patents. On information and belief, the Apple retail store at 125 Christiana Mall sells more infringing products than any other Apple retail store in the United States. *See* Alan Farnham and Mark Mooney, *Apple's (AAPL) Delaware Store Claims Title for Selling Most iPhones*, ABC NEWS (Nov. 12, 2013, 6:14 AM), https://abcnews.go.com/Business/apples-delaware-store-claims-title-selling-iphones/story?id=20650009.

TECHNOLOGY BACKGROUND

24. The technology at issue in this case relates to the field of audio and speech codecs used in mobile telecommunications, including, but not limited to LTE user devices.

25. Since the advent of the telephone, delivering high quality audio over constrained bandwidth channels has been a challenge. Generally speaking, delivery requires balancing two competing demands: bandwidth utilization and audio quality.

26. Bandwidth utilization can be measured by the number of bits per second that are transmitted—the "bit rate." The less bandwidth assigned to a given telephone call, the more simultaneous calls a mobile phone system can support.

This is because mobile phone carriers are only assigned a finite portion of the radio frequency spectrum. Thus, bandwidth utilization is improved when the bit rate is lower.

27. Audio quality can be measured, for example, by the subjective response of listeners to a call. One example of a way to assess users' opinion of call quality is a Mean Opinion Score, or "MOS." For a given bit rate, the performance of codecs may be evaluated by an MOS. Higher MOS values reflect subjectively better audio quality.

28. Audio quality can be improved if a larger part of the audio spectrum is transmitted. The portion of the audio spectrum transmitted can be measured in hertz or "Hz." In so-called "narrowband" use, audio frequencies in the range 20-4000 Hz are theoretically used, though the actual bandwidth used is typically 300-3400 Hz for audio. In wideband use, audio frequencies theoretically range from 20-8000 Hz; in super wideband use, audio frequencies theoretically range from 20-16000 Hz; and in fullband, audio frequencies theoretically range from 20-20000 Hz. Transmitting wider band audio frequencies (which includes super wideband and fullband), however, generally requires using an increased bit rate.

29. To deliver greater audio quality using less bandwidth, audio signals at a transmitting handset are generally passed through an "encoder," a codec that converts analog audio signals into processed digital signals. At the receiving handset, a "decoder" reverses the process, converting the received digital signals into analog signals suitable for the receiving handset's speaker.

30. Modern speech codecs rely on two primary forms of coding: waveform-based speech coding and parametric-based speech coding.

31. Waveform-based speech coding focuses heavily on analyzing the shape of a sound wave (including speech signals and non-speech signals), removing redundant and unnecessary components of the audio signals, and

transferring the modified wave to a decoder. In practice, this technique produces reasonably good sound quality but is comparatively ineffective at low bit-rate audio signal processing.

32. Parametric-based speech coding attempts to model the characteristics of the human vocal tract within very short bursts of time (*e.g.*, 20 ms frames) of a sound wave. This information, which is essentially a description of the speaker's vocal tract and its temporal evolution, is then transferred to a decoder that reconstructs the vocal pattern and performs speech synthesis in order to generate audio signals that resemble the original input. Parametric-based speech coding is very effective at low bit-rate transmission because it eliminates much of the data associated with the waveform, but often results in computerized and mechanical vocal reproduction.

33. One hybrid approach to these two coding types is called the Algebraic code-excited linear prediction ("ACELP") technique—an improvement on the code-excited linear prediction ("CELP") technique. The ACELP technique combines waveform and parametric-based speech coding techniques with linear prediction of sound waves using past frames and the use of a codebook. Codebooks store indexed sound patterns at both the encoder and decoder, allowing the transfer of only the indices to those sound patterns instead of complete sound patterns.

34. Broadly speaking, encoders use codebooks in the following way, which is sometimes called "analysis by synthesis." *See* '710 patent at 6:39-43. The encoder stores the sample of audio to be encoded. It then generates ("synthesizes") audio using various entries in the codebook and compares ("analyzes") each of these synthesized sounds with the audio to be encoded. The entries in the codebook are called codevectors. The analysis is completed when the encoder finds a

codevector that best, or most closely, synthesizes a sound that matches the stored audio.

35. The ACELP model was pioneered by VoiceAge Corporation and is utilized by the AMR-WB speech codec—the required codec for the Global System for Mobile Communications ("GSM") and Wide Band Code Division Multiple Access ("WCDMA") (i.e., 3rd Generation cellular networks). The AMR-WB speech codec, however, had several limitations, including being limited to narrowband and wideband implementations.

36. In 2014, the global telecommunications standards body, 3GPP, adopted a successor to the AMR-WB codec known as the Enhanced Voice Services, or EVS codec. The EVS codec addressed some of the limitations of the prior AMR-WB codec. The EVS codec was developed by the collaboration between several leading companies in the industry, including manufacturers (chipset, handset, infrastructure), operators, and technology providers. As part of this process, the EVS codec was standardized. Standardization followed the rigorous 3GPP process, which included setting aggressive requirements and design constraints, with qualification, selection, and characterization phases comprising extensive subjective testing performed by world-renowned independent test labs. VoiceAge Corporation was a recognized leading contributor to the EVS codec as developed and then embodied in the 3GPP standard.

37. The EVS codec is embodied in 3GPP standards documents known as technical specifications ("TS"). The 26 series of technical specifications cover various aspects of the EVS codec, including at least 26.441, 26.442, 26.443, 26.444, 26.445, 26.446, 26.447, 26.448, 26.449, 26.450, 26.451, 26.114 and 26.952 (collectively the "EVS Standard").

NOTICE AND COMPLIANCE WITH FRAND OBLIGATIONS

38. The asserted VoiceAge Patents are essential to the EVS Standard.

39. All of the asserted VoiceAge Patents have been declared essential to the EVS Standard by way of Intellectual Property Rights ("IPR") Declarations to one or more of 3GPP's organizational partners.

40. Each asserted VoiceAge Patent was independently evaluated by the International Patent Evaluation Consortium ("IPEC") and determined to be essential to the EVS Standard.

41. IPEC Declarations of Essentiality are publicly available on the VoiceAge EVS website. *See* VoiceAge EVS IPEC Reports, http://www.voiceageevs.com/ipec.aspx (last visited Aug. 11, 2020).

42. Each IPEC Declaration identifies two claims of the VoiceAge Patent that was found to be essential to the EVS Standard, the particular sections of the EVS Standard relevant to the identified VoiceAge Patent claims, and products relevant to the identified VoiceAge Patent claims (e.g., terminal products and/or base station products).

43. On information and belief, Apple is an active participant in 3GPP at least by participation of related entities such as Apple (UK) Limited and Apple GmbH through 3GPP organizational partners such as the European Telecommunications Standards Institute ("ETSI").

44. Through its participation in 3GPP, Apple has or should have knowledge of the asserted VoiceAge Patents and the fact that the asserted VoiceAge Patents have been declared essential to the EVS Standard.

45. In a letter dated March 24, 2020 from VoiceAge EVS CEO David Rosmann addressed to the General Counsel of Apple, VoiceAge EVS invited Apple to learn more about the VoiceAge EVS patent portfolio and to license its patents essential to the EVS standard. The letter indicated that an independent patent evaluation consortium had reviewed the VoiceAge EVS patent portfolio and declared patents in all fourteen patent families essential to the EVS standard. The

letter also indicated that upon execution of a mutual non-disclosure agreement ("NDA"), VoiceAge EVS could provide Apple with a standard-essential license, licensing rate tables, and additional detailed materials regarding the VoiceAge EVS patent portfolio. The letter directed Apple to the VoiceAge EVS website, www.voiceageevs.com, for further information.

46. Apple received the March 24, 2020 letter from VoiceAge EVS on or around March 30, 2020.

47. After two months of no response from Apple, VoiceAge EVS reached out to Apple again. On May 28, 2020, again by letter from Mr. Rosmann to the General Counsel of Apple, VoiceAge EVS invited Apple to learn more about the VoiceAge EVS patent portfolio and licensing.

48. Apple received the May 28, 2020 letter from VoiceAge EVS on or around May 29, 2020.

49. On Sunday, May 31, 2020, after more than two months of silence, Apple finally responded to VoiceAge EVS's March 24, 2020 letter. By way of e-mail, a representative of Apple, Mr. David Schumann, confirmed receipt of the March 24, 2020 letter and indicated that Apple had reviewed the prior correspondence and the VoiceAge EVS website and inquired as to VoiceAge EVS's availability for a call later in the week.

50. Later that day, Mr. Rosmann responded to Mr. Schumann's e-mail, offering a call on either Monday or Tuesday of that week.

51. After rescheduling twice at the request of Apple, on June 3, 2020, representatives of Apple and VoiceAge EVS participated in a short call regarding VoiceAge EVS's invitation to enter into licensing discussions. Following the call, VoiceAge EVS provided Apple an NDA template to facilitate licensing discussions and the further disclosure of information, including claim charts.

VoiceAge EVS further indicated that updated license templates would be made available on the VoiceAge EVS website in the coming days.

52. Almost one month later, on July 1, 2020, Apple responded, by way of e-mail from Mr. Ryan Yang, that Apple had reviewed the proposed NDA provided after the June 3, 2020 meeting and requested a conference call on Thursday, July 9, 2020.

53. Later that day, Mr. Rosmann responded to Mr. Yang's e-mail, confirming availability for a call on July 9, 2020.

54. On July 9, 2020, representatives of Apple, Mr. Yang and Mr. Jeffrey Lasker, participated in a phone conference with Mr. Rosmann. On the call, Mr. Rosmann reported that updated license templates had been posted to the VoiceAge EVS website and that VoiceAge EVS's entire global patent list and IPEC Declarations confirming standard essentiality of all fourteen families in the EVS patent portfolio were also available on the VoiceAge EVS website. Mr. Rosmann advised Apple that it could share additional information with Apple including detailed claim charts prepared by IPEC and information regarding VoiceAge EVS's licensing program upon execution of the NDA. Mr. Lasker initially advised that Apple was not interested in executing an NDA because NDAs always "came back to bite Apple" during litigation and he didn't believe one was necessary. Mr. Lasker agreed to reconsider this position and continue to review VoiceAge EVS's proposed NDA previously sent on June 3, 2020.

55. After hearing nothing further from Apple in almost two weeks, Mr. Rosmann sent an e-mail to Mr. Lasker and Mr. Yang on July 21, 2020 asking whether Apple had decided whether to proceed under the proposed NDA.

56. Mr. Lasker responded on July 24, 2020, advising that Apple was fine in proceeding without an NDA and again reiterating Apple's position that it did not believe that one was necessary to further licensing discussions.

57. On July 31, 2020, Mr. Rosmann again requested that Apple reconsider its position on an NDA, pointing out that the use of an NDA is a normal and customary practice of conducing licensing discussions and advising that all of VoiceAge EVS's licensees and potential licensees to date have followed this uniform practice to proceed under an NDA. Mr. Rosmann indicated that VoiceAge EVS would be willing to consider Apple's NDA template and invited Apple to provide edits to VoiceAge EVS's proposed NDA to address any of Apple's reservations. Mr. Rosmann reiterated that it was VoiceAge EVS's hope that an NDA would offer full transparency and allow VoiceAge EVS to share as much information as possible with Apple, including confidential and proprietary materials such as claim charts, market information, business forecasts and other data for which VoiceAge EVS had made a substantial financial investment. Mr. Rosmann again offered to share detailed claim charts prepared by IPEC as well as offering real-time technical assistance to Apple in its review of VoiceAge EVS's patents under an NDA.

58. On August 3, 2020, two full months after VoiceAge EVS sent Apple a proposed NDA, Mr. Lasker responded stating Apple would enter into a narrow NDA that only covers VoiceAge EVS's "existing financial and license agreement information." Mr. Lasker made no offer to share any Apple information under an NDA. Despite VoiceAge EVS's repeated offers to provide its detailed claim charts prepared by IPEC under an NDA, Mr. Lasker accused VoiceAge EVS of refusing to provide the claim charts. Mr. Lasker acknowledged that Apple was aware of the IPEC Declarations for the fourteen patent families in VoiceAge EVS's patent portfolio. Despite having knowledge of the VoiceAge EVS website and the IPEC Declarations since March 2020, Mr. Lasker would only confirm that Apple had "begun [its] technical assessment based on the available information and declarations."

59. The use of a fulsome NDA to facilitate patent licensing discussions is a normal and customary industry practice. An NDA allows the parties to engage in full and frank discussions without putting either party in apprehension of suit or legal jeopardy while good faith discussions occur.

60. Apple has publicly stated its position that NDAs impede its ability to pre-emptively file declaratory judgment actions against patent licensors. *See Apple Inc. v. Koss Corporation*, 20-cv-5504, D.I. 1 at 2 (N.D. Cal.).

61. Apple declined to offer written assurances to VoiceAge EVS that it would not share with third parties or use the disclosure of VoiceAge EVS's confidential information to file a pre-emptive declaratory judgment action or take other legal action against VoiceAge EVS.

62. As indicated above, during its communications with Apple, VoiceAge EVS directed Apple multiple times to the VoiceAge EVS license templates available on the VoiceAge EVS website. The license templates included both running royalty and lump sum license options as well as a running royalty rate summary.

63. Throughout these interactions, Apple never expressed a willingness to take a license from VoiceAge EVS on FRAND terms. Instead, Apple was nonresponsive, repeatedly delayed discussions, and refused to have good faith discussions under an NDA, contrary to the letter and spirit of FRAND. Thus, VoiceAge EVS was left with no other choice but to initiate this lawsuit.

THE VOICEAGE PATENTS

64. All right, title and interest in each of the VoiceAge Patents were assigned by their respective inventors to VoiceAge Corporation. Each of the assignments from the inventors to VoiceAge Corporation were duly recorded with the United States Patent Office ("USPTO") and are attached to the Complaint as Exhibits 6-10.

65. On December 5, 2018, VoiceAge Corporation assigned all right, title, and interest in the VoiceAge Patents to VoiceAge EVS. This assignment included all causes of action for past, current, and future infringement as well as all causes of action and other enforcement rights for damages, injunctive relief, and any other remedies of any kind. The assignment further included all rights to collect royalties and other payments under or on account of the VoiceAge Patents. The assignment from VoiceAge Corporation to VoiceAge EVS was duly recorded with the USPTO and is attached to the Complaint as Exhibit 11.

66. VoiceAge EVS solely owns all rights, titles, and interests in and to the VoiceAge Patents, each described below.

I. The ’710 Patent

67. The ’710 patent, entitled “Method and device for efficient frame erasure concealment in linear predictive based speech codecs,” was duly and legally issued on April 6, 2010, from a patent application filed May 30, 2003, with Milan Jelinek and Philippe Gournay as named inventors. The ’710 patent claims priority to Canadian Application No. 2388439, filed on May 31, 2002.

68. The inventions disclosed in the ’710 patent cover, for example, techniques for improving synthesized speech quality in digital speech communication systems, especially when operating in wireless environments and packet-switched networks. *See, e.g.,*’710 patent, 11:18-36. The inventions provide techniques for the digital “encoding and decoding of sound signals to maintain good performance in case of erased frame(s) due, for example, to channel errors in wireless systems or lost packets in voice over packet network applications.” *See, e.g.*, *id.*, 1:18-25.

69. In wireless cellular environments and packet-switched networks, high bit error rates or a long delay can result in erased frames. *See*, *e.g.*, *id.*, 11:21-36. “In these systems, the codec is subjected to typically 3 to 5% frame erasure rates.”

See, e.g., *id.* "The erasure of frames has a major effect on the synthesized speech quality in digital speech communication systems, especially when operating in wireless environments and packet-switched networks." *See, e.g.*, *id.*, 11:18-21.

70. The '710 patent explains that "[t]he problem of frame erasure (FER) processing is basically twofold. First, when an erased frame indicator arrives, the missing frame must be generated by using the information sent in the previous frame and by estimating the signal evolution in the missing frame. The success of the estimation depends not only on the concealment strategy, but also on the place in the speech signal where the erasure happens. Secondly, a smooth transition must be assured when normal operation recovers, i.e. when the first good frame arrives after a block of erased frames (one or more). This is not a trivial task as the true synthesis and the estimated synthesis can evolve differently. When the first good frame arrives, the decoder is hence desynchronized from the encoder. The main reason is that low bit rate encoders rely on pitch prediction, and during erased frames, the memory of the pitch predictor is no longer the same as the one at the encoder. The problem is amplified when many consecutive frames are erased. As for the concealment, the difficulty of the normal processing recovery depends on the type of speech signal where the erasure occurred." *See, e.g.*, *id.*, 11:38-57.

71. The '710 patent discloses particular solutions to the technical problem of FER processing by "improving concealment of frame erasure caused by frames of an encoded sound signal erased during transmission from an encoder to a decoder, and for accelerating recovery of the decoder after non erased frames of the encoded sound signal have been received[.]" *See, e.g.*, *id.*, 2:58-63.

72. The '710 patent, for example, discloses use of concealment/recovery parameters determined in the encoder and transmitted to the decoder. *See, e.g.*, *id.*, 2:58-3:48.

73. According to one embodiment, these concealment/recovery parameters include classification of each frame according to the type of speech signal, information about the signal energy, and phase information. *See, e.g.*, *id.*, 11:58-12:5, 12:65-13:2, 13:13-32, 21:2-37, 22:37-39, 31:40-44, 35:63-67.

74. Classifying each frame at the encoder according to the type of speech signal permits taking into account the future signal behavior, and has the advantage of working with the original signal instead of the synthesized signal if desired. *See, e.g.*, *id.*, 13:38-50. The decoder handles frame erasure and recovery in response to the received concealment/recovery parameters. *See, e.g.*, *id.*, 3:25-28, 31:47-49, 35:60-36:17. In this way, the negative effect of frame erasures can be mitigated by adapting concealment and recovery from frame erasure to the type of the speech signal where the erasure occurs. *See, e.g.*, *id.*, 11:58-12:5.

75. According to the USPTO examiner, the claims of the ’710 patent issued because, among other reasons, “the prior art of record does not disclose or reasonably suggest the limitations of classifying successive frames as unvoiced, unvoiced transition, voiced transition, voiced, or onset, and calculating an energy information parameter in relation to a maximum of a signal energy for frames classified as voiced or onset, and calculating the energy information parameter in relation to average energy per samples for other frames, in combination with determining and transmitting concealment recovery parameters and conducting frame erasure concealment.” ’710 File History, Notice of Allowance, December 18, 2009, at 3; *see also id.* at 2-4.[4]

II. The ’843 Patent

76. The ’843 patent, entitled “Method and device for coding transition frames in speech signals,” was duly and legally issued on March 19, 2013, from a

[4] Cited excerpts of the ’710 file history attached as Exhibit 12.

patent application filed October 24, 2007, with Vaclav Eksler, Milan Jelinek, and Redwan Salami as named inventors. The '843 patent claims priority to U.S. Provisional Application No. 60/853,749, filed on October 24, 2006.

77. The inventions disclosed in the '843 patent cover techniques "for digitally encoding a sound signal, for example a speech or audio signal, in view of transmitting and synthesizing this sound signal." *See, e.g.*, '843 patent, 1:6-9. For example, the patent discloses techniques "for encoding transition frames in a predictive speech and/or audio encoder in order to improve the encoder robustness against lost frames and/or improve the coding efficiency." *See, e.g., id.*, 2:51-55.

78. The '843 patent explains that "CELP-type speech codecs rely heavily on prediction to achieve their high performance. The prediction used can be of different kinds but usually comprises the use of an adaptive codebook containing an excitation signal selected in past frames. A CELP encoder exploits the quasi periodicity of voiced speech signal by searching in the past excitation the segment most similar to the segment being currently encoded. The same past excitation signal is maintained also in the decoder." *See, e.g., id.*, 1:63-2:4.

79. The '843 patent explains that "[a] problem of strong prediction inherent in CELP-based speech coders appears in presence of transmission errors (erased frames or packets) when the state of the encoder and the decoder become desynchronized. Due to the prediction, the effect of an erased frame is thus not limited to the erased frame, but continues to propagate after the erasure, often during several following frames. Naturally, the perceptual impact can be very annoying." *See, e.g., id.*, 2:10-17.

80. The '843 patent discloses particular solutions to solving this and other technical problems. One embodiment disclosed in the '843 patent includes a "transition mode (TM) encoding technique[.]" *See, e.g., id.*, 5:59-64. The TM encoding technique refers to collecting transition frames and frames following the

transition in a sound signal, for example a speech or audio signal. "The TM coding technique replaces the adaptive codebook of the CELP codec by a new codebook of glottal impulse shapes, hereinafter designated as glottal-shape codebook, in transition frames and in frames following the transition. The glottal-shape codebook is a fixed codebook independent of the past excitation. Consequently, once a frame erasure is over, the encoder and the decoder use the same excitation whereby convergence to clean-channel synthesis is quite rapid." *See, e.g.*, *id.*, 5:59-6:5.

81. The '843 inventions can, for example, "eliminate error propagation and increase coding efficiency in CELP-based codecs by replacing the inter-frame dependent adaptive codebook search by a non-predictive, for example glottal-shape, codebook search. This technique requires no extra delay, negligible additional complexity, and no increase in bit rate compared to traditional CELP encoding." *See, e.g.*, *id.*, 2:56-62.

82. According to the USPTO examiner, the claims of the '843 patent issued because, among other reasons, the prior art at issue "d[id] not fairly teach or suggest a transition mode codebook for generating a set of codevectors independent from past excitation, the transition mode codebook being responsive to the codebook index for generating, in the transition frame and/or the at least one frame following the transition, one of the codevectors of the set corresponding to said transition mode excitation; wherein the transition mode codebook comprises a codebook of glottal impulse shapes." '843 File History, Notice of Allowance, December 21, 2012, at 2.[5]

[5] Cited excerpts of the '843 file history attached as Exhibit 13.

III. The ’073 Patent

83. The ’073 patent, entitled “Method and device for sound activity detection and sound signal classification,” was duly and legally issued on March 24, 2015, from a patent application filed June 20, 2008, with Vladimir Malenovsky, Milan Jelinek, Tommy Vaillancourt, and Redwan Salami as named inventors. The ’073 patent claims priority to U.S. Provisional Application No. 60/929,336, filed on June 22, 2007.

84. The inventions disclosed in the ’073 patent relate to the technical problem of “sound activity detection, background noise estimation and sound signal classification where sound is understood as a useful signal.” ’073 patent, 1:7-9. In one aspect, the techniques claimed by the ’073 patent include a “Sound Activity Detection (SAD) algorithm where sound could be speech or music or any useful signal.” *See, e.g.*, *id.*, 2:48-50. The “tonal stability detection [is] used to improve the performance of the SAD algorithm in case of music signals.” *See, e.g.*, *id.*, 2:50-53.

85. In one embodiment of the ’073 patent, the techniques for estimating tonal stability include “calculating a current residual spectrum of the sound signal; detecting peaks in the current residual spectrum; calculating a correlation map between the current residual spectrum and a previous residual spectrum for each detected peak; and calculating a long-term correlation map based on the calculated correlation map, the long-term correlation map being indicative of a tonal stability in the sound signal.” *See, e.g.*, *id.*, Abstract. “Tonal stability estimation is used to improve the performance of sound activity detection in the presence of music signals, and to better discriminate between unvoiced sounds and music.” *See, e.g.*, *id.*, 1:26-29. In this way, “[f]or example, the tonal stability estimation may be used in a super-wideband codec to decide the codec model to encode the signal above 7 kHz.” *See, e.g.*, *id.*, 1:29-32, 16:56-58.

86. The ’073 patent thus claims particular solutions to solving the technical problem of “sound activity detection, background noise estimation and sound signal classification where sound is understood as a useful signal” (*id.*, 1:7-9) and other technical problems using, for example, particular techniques for “estimating a tonal stability of a sound signal” and “us[ing tonal stability estimation] to improve the performance of sound activity detection in the presence of music signals, and to better discriminate between unvoiced sounds and music.” *See, e.g.*, *id.*, Abstract, 1:26-29.

87. According to the USPTO examiner, the claims of the ’073 patent issued because, among other reasons, “[t]he closest relevant prior art . . ., either taken individually or in combination, fails to explicitly teach or reasonably suggest the invention as represented by method claim 1.” ’073 File History, Notice of Allowance, November 6, 2014, at 3.[6] The patent examiner recognized that the claimed inventions “provided a novel way of estimating the tonal stability of a sound signal, thus taken as a whole this claim represents a new inventive concept.” *Id.* For example, the examiner found that the prior art did “not teach identifying the tonal stability of the sound signal based on calculating a long-term correlation map, wherein the long-term correlation map is calculated based on an update factor, the correlation map of a current frame, and an initial value of the long term correlation map.” *Id.* at 3-7.

IV. The ’475 Patent

88. The ’475 patent, entitled “Transform-domain codebook in a CELP coder and decoder,” was duly and legally issued on September 2, 2014, from a patent application filed May 11, 2012, with Vaclav Eksler as the named inventor.

[6] Cited excerpts of the ’073 file history attached as Exhibit 14.

The ’475 patent claims priority to U.S. Provisional Application No. 61/484,968, filed on May 11, 2011.

89. The inventions disclosed in the ’475 patent allow techniques for improving the quality of encoded speech at higher bitrates. *See, e.g.*, ’475 patent, 1:60-2:2.

90. The ACELP model, as explained by the ’475 patent, “[a]lthough very efficient to encode speech at low bit rates, [] cannot gain in quality as quickly as other approaches (for example transform coding and vector quantization) when increasing the ACELP codebook size.” *See, e.g., id.* “At lower bit rates (for example bit rates lower than 12 kbits/s), the ACELP model captures quickly the essential components of the excitation. But at higher bit rates, higher granularity and, in particular, a better control over how the additional bits are spent across the different frequency components of the signal are useful.” *See, e.g., id.*, 2:5-10.

91. The ’475 patent discloses particular solutions to solve this and other technical problems by “modify[ing] the CELP model such that another additional codebook stage is used to form the excitation.” *See, e.g., id.*, 5:60-67. The additional codebook stage is “referred to as a transform-domain codebook stage as it encodes transform-domain coefficients.” *See, e.g., id.* The patent further describes multiple embodiments with the additional codebook. *See, e.g., id.*, 2:33-62, 13:4-14. In the one embodiment (or structure), the “modified CELP model us[es] a transform-domain codebook stage followed by an innovative codebook stage[.]” *See, e.g., id.*, 10:15-19. “Contrary to the first structure of modified CELP model where the transform-domain codebook stage can be seen as a pre-quantizer for the innovative codebook stage, the transform-domain codebook stage in the second codebook arrangement of the second structure of modified CELP model is used as a stand-alone third-stage quantizer (or a second-stage quantizer if the innovative codebook stage is not used).” *See, e.g., id.*, 10:31-37. In one exemplary

embodiment, "[a] selector may be provided to select an order of the time-domain CELP codebook and the transform-domain codebook in First and Second Codebook Stages, respectively, as a function of characteristics of the input sound signal." *Id.* at Abstract; *see also* 2:57-62.

92. The '475 patent further explains that "[a]lthough the transform-domain codebook stage puts usually more weights in coding the perceptually more important lower frequencies, contrary to the transform-domain codebook stage in the first codebook arrangement to whiten the excitation residual after subtraction of the adaptive and innovative codebook excitation contributions in all the frequency range. This can be desirable in coding the noise-like (inactive) segments of the input sound signal." *See, e.g.*, *id.*, 10:37-44.

93. According to the USPTO examiner, the claims of the '475 patent issued because, among other reasons, "[t]he prior art taken alone or in combination fail[ed] to teach 'a selector of an order of the CELP innovative codebook stage and the transform-domain codebook stage as a function of at least one of (a) characteristics of the input sound signal and (b) a bit rate of a codec using the CELP codebook coding device, wherein the selector comprises switches having a first position where the CELP innovative codebook stage is first and followed by the transform-domain codebook stage and a second position where the transform-domain codebook stage is first and followed by the CELP innovative codebook stage, and wherein: in the first position of the switches, the second calculator determines the second target signal using the first target signal and information from the CELP adaptive codebook stage and the third calculator determines the third target signal using the second target signal and information from the CELP innovative codebook stage; and in the second position of the switches, the third calculator determines the third target signal using the first target signal and information from the CELP adaptive codebook stake and the second calculator

determines the second target signal using the first target signal and information from the CELP adaptive codebook stage and the transform domain codebook stage, wherein each of the first calculator, the CELP adaptive codebook stage, the CELP innovative codebook stage, the transform-domain codebook stage, the second calculator, the third calculator, and the selector is configured to be processed by one or more processors, wherein the one or more processors is coupled to a memory.'" '475 File History, Notice of Allowance, June 4, 2014, at 2-3.[7]

V. The '741 Patent

94. The '741 patent, entitled "Methods, encoder and decoder for linear predictive encoding and decoding of sound signals upon transition between frames having different sampling rates," was duly and legally issued on December 26, 2017, from a patent application filed April 2, 2015, with Redwan Salami and Vaclav Eksler as named inventors. The '741 patent claims priority to U.S. Provisional Application No. 61/980,865, filed on April 17, 2014.

95. The inventions disclosed in the '741 patent relate to "efficient interpolation of LP parameters between two frames at different internal sampling rates." *See, e.g.*, '741 patent, 7:41-43. Said another way, the inventions relate to methods and an encoder and a decoder "for transition between frames with different internal sampling rates." *See, id.*, Abstract.

96. As the '741 patent explains, "[d]ifferent internal sampling rates may be used at different bit rates to improve quality in multi-rate LP-based coding." *See, e.g., id.*, 7:27-29. "In multi-rate coders the codec should be able to switch between different bit rates on a frame basis without introducing switching artefacts. In AMR-WB this is easily achieved since all the bit rates use CELP at

[7] Cited excerpts of the '475 file history attached as Exhibit 15.

12.8 kHz internal sampling. However, in a recent coder using 12.8 kHz sampling at bit rates below 16 kbit/s and 16 kHz sampling at bit rates higher than 16 kbits/s, the issues related to switching the bit rate between frames using different sampling rates need to be addressed." *See, e.g., id.*, 2:47-55; 7:35-40.

97. One approach to solving the technical problem "involves re-sampling the past synthesis signal from rate S**1** to rate S**2**, and performing complete LP analysis, this operation being repeated at the decoder, which is usually computationally demanding." *See, e.g., id.*, 7:48-64.

98. The '741 patent, however, takes a different approach—"without the need to re-sample the past synthesis and perform complete LP analysis." *See, e.g., id.*, 7:65-8:8. It discloses particular solutions to solving this technical problem with improved conversion of LP synthesis filter parameters between different sampling rates. For example, the '741 patent claims a method and device for computing the power spectrum of the LP synthesis filter at a first rate, modifying the power spectrum to convert it from a first rate to a second rate, converting the modified power spectrum back to the time domain to obtain the filter autocorrelation at the second rate, and finally using the autocorrelation to compute LP filter parameters at the second rate. *See, e.g., id.*

99. According to the USPTO examiner, the claims of the '741 patent issued because, among other reasons, "the prior art fails to teach or suggest, either alone or in combination, for having 'a method for encoding a sound signal, comprising, producing, in response to the sound signal, parameters for encoding the sound signal during successive sound signal processing frames, wherein the sound signal encoding parameters include linear predictive (LP) filter parameters, wherein producing the LP filter parameters comprises, when switching from a first one of the frames using an internal sampling rate S1 to a second one of the frames using an internal sampling rate S2, converting the LP filter parameters from the

first frame from the internal sampling rate S1 to a the internal sampling rate S2, the and wherein converting the LP filter parameters from the first frame, and wherein herein modifying the power spectrum of the LP synthesis filter to convert it from the internal sampling rate SI to the internal sampling rate S2 comprises: if SI is less than S2, extending the power spectrum of the LP synthesis filter based on a ratio between SI and S2; if SI is larger than S2, truncating the power spectrum of the LP synthesis filter based on the ratio between SI and S2.'" '741 File History, Notice of Allowance, September 5, 2017, at 9-10.[8]

APPLE'S DIRECT INFRINGEMENT

100. Apple has directly infringed and continues to directly infringe the VoiceAge Patents by, for example, making, using, offering to sell, selling, and/or importing into the United States without authority, products, equipment, software, and/or services that practice one or more claims of each of the VoiceAge Patents, including without limitation Apple's mobile devices and other devices with EVS codec capabilities compliant with the EVS Standard. These Defendant devices include, but are not limited to, the Apple iPhone 11, equivalents thereto, and the devices listed in Appendix A (Apple's "EVS Products").

101. The EVS codec is a speech audio coding standard defined by the EVS Standard.

102. Each of Apple's EVS Products include hardware and software that implements the EVS codec, which is defined by the EVS Standard. For example, certain of Apple's EVS Products are identified by a Global mobile Suppliers Association Report as supporting the EVS codec.[9] In addition, hardware and/or

[8] Cited excerpts of the '741 file history attached as Exhibit 16.

[9] Global mobile Suppliers Association, Enhanced Voice Services (EVS): Market Update (May 2019) attached as Exhibit 17.

software components comprising Apple's EVS Products are publicly identified as supporting the EVS codec and/or Enhanced HD Voice, Ultra HD Voice, or HD Voice+ services.

103. The VoiceAge Patents are essential to the EVS Standard.

104. Because Apple's EVS Products include hardware and/or software components supporting the EVS codec compliant with the EVS Standard, Apple necessarily infringes the VoiceAge Patents.

105. On information and belief, Apple tests or directs or controls others to test Apple's EVS Products to ensure they include hardware and software compliant with the EVS Standard.

APPLE'S INDIRECT INFRINGEMENT

106. Apple has indirectly infringed and continues to indirectly infringe the VoiceAge Patents by inducing third parties to directly infringe those patents.

107. Apple has induced, and continues to induce, direct infringement of the VoiceAge Patents by customers, importers, sellers, resellers, and/or end users of Apple's EVS Products.

108. Apple has had actual knowledge or has been willfully blind to the existence of the VoiceAge Patents, Apple's infringement of the VoiceAge Patents, and the infringement of the VoiceAge Patents by Apple's customers beginning on or shortly after receipt of the March 24, 2020 letter from VoiceAge EVS.

109. On August 12, 2020, before filing of this Complaint, counsel for VoiceAge EVS sent Apple a letter identifying each of the asserted VoiceAge Patents, asserting that Apple directly and indirectly infringed the VoiceAge Patents, and identifying relevant portions of the EVS Standard for at least one claim of each VoiceAge Patent.

110. Thus, alternatively, at the very latest, Apple has had actual knowledge of the VoiceAge Patents and has had actual knowledge of or has been willfully

blind to its infringement of the VoiceAge Patents and the infringement of the VoiceAge Patents by its customers as of August 12, 2020 based on the letter and/or the filing of this Complaint.

111. Apple knows the EVS Products, and similar devices, practice the EVS Standard. Apple further knows, from the communications from VoiceAge EVS recited above, its participation in the mobile device industry, and public sources, that the VoiceAge Patents are essential to practicing the EVS Standard. Despite this knowledge, Apple continues to encourage its customers to use the EVS Products and infringe the VoiceAge Patents.

112. More specifically, Apple knows that the use of Apple's mobile devices, and other devices with EVS codec capabilities compliant with the EVS Standard, to make a voice call using the EVS codec, constitutes infringement of the VoiceAge Patents.

113. Apple advertises the infringing products and services, publishes specifications and promotional literature encouraging customers to operate the accused products and services, creates and/or distributes user manuals for the accused products and services that provide instruction and/or encourage infringing use, and offers support and/or technical assistance to its customers that provide instructions on and/or encourage infringing use.

114. Apple encourages and facilitates its customers to infringe the VoiceAge Patents by instructing customers that purchase Apple's EVS Products that such devices have voice calling capability and providing various indicators within those devices of the same.

115. For instance, Apple provides its customers with a user guide for each of the accused EVS Products.[10] The user guide includes instructions on how to

[10] *See iPhone User Guide*, https://support.apple.com/guide/iphone/welcome/ios

make a phone call.[11] Using an accused device to make a phone call on an EVS-supported wireless carrier network, e.g., T-Mobile, results in infringement of the VoiceAge Patents.

116. End users of Apple's EVS Products, pursuant to Apple's instructions, indicators, and advertisements, thus each directly infringe the VoiceAge Patents.

117. Apple continues to encourage and facilitate the direct infringement of the VoiceAge Patents by end users of Apple's EVS Products.

COUNT I: INFRINGEMENT OF U.S. PATENT NO. 7,693,710

118. VoiceAge EVS incorporates by reference the foregoing paragraphs.

119. Pursuant to 35 U.S.C. § 282, the '710 patent is presumed valid.

120. Upon information and belief, Apple has infringed, and is currently infringing, the '710 patent in violation of 35 U.S.C. § 271(a) by making, using, offering to sell, selling, and/or importing into the United States without authority, products, equipment, software, and/or services, including Apple's EVS Products, that practice one or more claims of the '710 patent.

121. Apple infringes at least claims 16 and 24 of the '710 patent because Apple's EVS Products include hardware and/or software implementing the EVS codec compliant with the EVS Standard and are therefore capable of performing concealment of frame erasure as claimed by the '710 patent and as described at least in 3GPP standards document TS 26.445 §§ 4.1, 4.4, and 5.5.

122. For example, as recited in claim 16, the Apple iPhone 11 is a device for conducting concealment of frame erasure caused by frames of an encoded sound signal erased during transmission from an encoder to a decoder, comprising:

(last visited Aug. 11, 2020).

[11] *See iPhone User Guide: Make a call on iPhone*, https://support.apple.com/guide/iphone/make-a-call-iph3c993cbc/ios (last visited Aug. 10, 2020), attached as Exhibit 18.

in the encoder, a determiner of concealment/recovery parameters selected from the group consisting of a signal classification parameter, an energy information parameter and a phase information parameter related to the sound signal; and a communication link for transmitting to the decoder concealment/recovery parameters determined in the encoder; wherein: the decoder conducts frame erasure concealment and decoder recovery in response to the concealment/recovery parameters received from the encoder; the sound signal is a speech signal; the determiner of concealment/recovery parameters comprises a classifier of successive frames of the encoded sound signal as unvoiced, unvoiced transition, voiced transition, voiced, or onset; and the determiner of concealment/recovery parameters comprises a computer of the energy information parameter in relation to a maximum of a signal energy for frames classified as voiced or onset, and in relation to an average energy per sample for other frames. *See*, *e.g.*, TS 26.445 V14.2.0 §§ 4.1, 4.4, and 5.5.

123. As recited in claim 24, the Apple iPhone 11 is also a device for conducting concealment of frame erasure caused by frames of an encoded sound signal erased during transmission from an encoder to a decoder, comprising: in the encoder, a determiner of concealment/recovery parameters selected from the group consisting of a signal classification parameter, an energy information parameter and a phase information parameter related to the sound signal; and a communication link for transmitting to the decoder concealment/recovery parameters determined in the encoder; wherein: the sound signal is a speech signal; the determiner of concealment/recovery parameters comprises a classifier of successive frames of the encoded sound signal as unvoiced, unvoiced transition, voiced transition, voiced, or onset; and the determiner of concealment/recovery parameters comprises a computer of the energy information parameter in relation to a maximum of a signal energy for frames classified as voiced or onset, and in

relation to an average energy per sample for other frames. *See*, *e.g.*, TS 26.445 V14.2.0 §§ 4.1, 4.4, and 5.5.

124. Apple induces third parties, including consumers, to infringe the ’710 patent in violation of 35 U.S.C. § 271(b) by facilitating and encouraging them to perform actions that Apple knows to be acts of infringement of the ’710 patent, including at least claims 16 and 24. Upon information and belief, Apple knows that the use of its mobile devices, and other devices with EVS codec capabilities compliant with the EVS Standard, including Apple’s EVS Products, constitutes infringement of the ’710 patent. Apple advertises the infringing products and services, publishes specifications and promotional literature encouraging customers to operate the accused products and services, creates and/or distributes user manuals for the accused products and services that provide instruction and/or encourage infringing use, and offers support and/or technical assistance to its customers that provide instructions on and/or encourage infringing use.

125. For instance, Apple encourages and facilitates its customers to infringe the ’710 patent by instructing customers that purchase the Apple iPhone 11 that such devices have voice calling capability, and providing various indicators within those devices of the same. Apple also encourages and facilitates its customers to infringe the ’710 patent by instructing customers that purchase the Apple iPhone 11 that such devices are compatible/operable on wireless carrier networks that support the EVS Standard. Apple’s customers, pursuant to Apple’s instructions and advertisements, each directly infringe the ’710 patent, including at least claims 16 and 24.

126. Apple’s infringement has caused and continues to cause damage to VoiceAge EVS, and VoiceAge EVS is entitled to recover damages sustained as a result of Apple’s wrongful acts in an amount subject to proof at trial.

COUNT II: INFRINGEMENT OF U.S. PATENT NO. 8,401,843

127. VoiceAge EVS incorporates by reference the foregoing paragraphs.

128. Pursuant to 35 U.S.C. § 282, the ’843 patent is presumed valid.

129. Upon information and belief, Apple has infringed, and is currently infringing, the ’843 patent in violation of 35 U.S.C. § 271(a) by making, using, offering to sell, selling, and/or importing into the United States without authority, products, equipment, software, and/or services, including Apple’s EVS Products, that practice one or more claims of the ’843 patent.

130. Apple infringes at least claims 11 and 14 of the ’843 patent because Apple’s EVS Products include hardware and/or software implementing the EVS codec compliant with the EVS Standard and are therefore capable of generating a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in a sound signal as claimed by the ’843 patent and as described at least in 3GPP standards document TS 26.445 V14.2.0 §§ 4.1, 4.4, 5.1, and 5.2.

131. For example, as recited in claim 11, the Apple iPhone 11 is a device for generating a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in a sound signal, comprising: a generator of a codebook search target signal; a transition mode codebook for generating a set of codevectors independent from past excitation, wherein the codevectors of said set each corresponds to a respective transition mode excitation and wherein the transition mode codebook comprises a codebook of glottal impulse shapes; a searcher of the transition mode codebook for finding the codevector of said set corresponding to the transition mode excitation optimally corresponding to the codebook search target signal. *See, e.g.*, TS 26.445 V14.2.0 §§ 4.1, 4.4, 5.1, and 5.2.

132. As recited in claim 14, the Apple iPhone 11 is also a device as defined in claim 11, wherein the sound signal comprises a speech signal and wherein the transition frame is selected from the group consisting of a frame comprising a voiced onset and a frame comprising a transition between two different voiced sounds. *See, e.g.*, TS 26.445 §§ 4.4 and 5.1.

133. Apple induces third parties, including consumers, to infringe the '843 patent in violation of 35 U.S.C. § 271(b) by facilitating and encouraging them to perform actions that Apple knows to be acts of infringement of the '843 patent, including at least claims 11 and 14. Upon information and belief, Apple knows that the use of its mobile devices, and other devices with EVS codec capabilities compliant with the EVS Standard, including Apple's EVS Products, constitutes infringement of the '843 patent. Apple advertises the infringing products and services, publishes specifications and promotional literature encouraging customers to operate the accused products and services, creates and/or distributes user manuals for the accused products and services that provide instruction and/or encourage infringing use, and offers support and/or technical assistance to its customers that provide instructions on and/or encourage infringing use.

134. For instance, Apple encourages and facilitates its customers to infringe the '843 patent by instructing customers that purchase the Apple iPhone 11 that such devices have voice calling capability, and providing various indicators within those devices of the same. Apple also encourages and facilitates its customers to infringe the '843 patent by instructing customers that purchase the Apple iPhone 11 that such devices are compatible/operable on wireless carrier networks that support the EVS Standard. Apple's customers, pursuant to Apple's instructions and advertisements, each directly infringe the '843 patent, including at least claims 11 and 14.

135. Apple's infringement has caused and continues to cause damage to VoiceAge EVS, and VoiceAge EVS is entitled to recover damages sustained as a result of Apple's wrongful acts in an amount subject to proof at trial.

COUNT III: INFRINGEMENT OF U.S. PATENT NO. 8,990,073

136. VoiceAge EVS incorporates by reference the foregoing paragraphs.

137. Pursuant to 35 U.S.C. § 282, the '073 patent is presumed valid.

138. Upon information and belief, Apple has infringed, and is currently infringing, the '073 patent in violation of 35 U.S.C. § 271(a) by making, using, offering to sell, selling, and/or importing into the United States without authority, products, equipment, software, and/or services, including Apple's EVS Products, that practice one or more claims of the '073 patent.

139. Apple infringes at least claims 31 and 36 of the '073 patent because Apple's EVS Products include hardware and/or software implementing the EVS codec compliant with the EVS Standard and are therefore capable of detecting sound activity in a sound signal, wherein the sound signal is classified as one of an inactive sound signal and an active sound signal according to the detected sound activity in the sound signal and estimating a tonal stability of a sound signal using a frequency spectrum of the sound signal as claimed by the '073 patent and as described at least in 3GPP standards document TS 26.445 § 5.1.

140. For example, as recited in claim 31, the Apple iPhone 11 is a device for estimating a tonal stability tonal stability of a sound signal using a frequency spectrum of the sound signal, the device comprising: a calculator of a current residual spectrum of the sound signal by subtracting from the frequency spectrum of the sound signal a spectral floor defined by minima of the frequency spectrum; a detector of a plurality of peaks in the current residual spectrum as pieces of the current residual spectrum between pairs of successive minima of the current residual spectrum; a calculator of a correlation map between each detected peak of

the current residual spectrum and a shape in a previous residual spectrum corresponding to the position of the detected peak; and a calculator identifying the tonal stability of the sound signal based on calculating a long-term correlation map, wherein the long-term correlation map is calculated based on an update factor, the correlation map of a current frame, and an initial value of the long-term correlation map. *See, e.g.*, TS 26.445 V14.2.0 § 5.1.

141. As recited in claim 36, the Apple iPhone 11 is also a device for detecting sound activity in a sound signal, wherein the sound signal is classified as one of an inactive sound signal and an active sound signal according to the detected sound activity in the sound signal, the device comprising: a tonal stability tonal stability estimator of the sound signal, used for distinguishing a music signal from a background noise signal; wherein the tonal stability tonal stability estimator comprises a device according to claim 31. *See, e.g.*, TS 26.445 V14.2.0 § 5.1.

142. Apple induces third parties, including consumers, to infringe the ’073 patent in violation of 35 U.S.C. § 271(b) by facilitating and encouraging them to perform actions that Apple knows to be acts of infringement of the ’073 patent, including at least claims 31 and 36. Upon information and belief, Apple knows that the use of its mobile devices, and other devices with EVS codec capabilities compliant with the EVS Standard, including Apple’s EVS Products, constitutes infringement of the ’073 patent. Apple advertises the infringing products and services, publishes specifications and promotional literature encouraging customers to operate the accused products and services, creates and/or distributes user manuals for the accused products and services that provide instruction and/or encourage infringing use, and offers support and/or technical assistance to its customers that provide instructions on and/or encourage infringing use.

143. For instance, Apple encourages and facilitates its customers to infringe the ’073 patent by instructing customers that purchase the Apple iPhone

11 that such devices have voice calling capability, and providing various indicators within those devices of the same. Apple also encourages and facilitates its customers to infringe the ’073 patent by instructing customers that purchase the Apple iPhone 11 that such devices are compatible/operable on wireless carrier networks that support the EVS Standard. Apple’s customers, pursuant to Apple’s instructions and advertisements, each directly infringe the ’073 patent, including at least claims 31 and 36.

144. Apple’s infringement has caused and continues to cause damage to VoiceAge EVS, and VoiceAge EVS is entitled to recover damages sustained as a result of Apple’s wrongful acts in an amount subject to proof at trial.

COUNT IV: INFRINGEMENT OF U.S. PATENT NO. 8,825,475

145. VoiceAge EVS incorporates by reference the foregoing paragraphs.

146. Pursuant to 35 U.S.C. § 282, the ’475 patent is presumed valid.

147. Upon information and belief, Apple has infringed, and is currently infringing, the ’475 patent in violation of 35 U.S.C. § 271(a) by making, using, offering to sell, selling, and/or importing into the United States without authority, products, equipment, software, and/or services, including Apple’s EVS Products, that practice one or more claims of the ’475 patent.

148. Apple infringes at least claims 1 and 3 of the ’475 patent because Apple’s EVS Products include hardware and/or software implementing the EVS codec compliant with the EVS Standard and are therefore capable of performing encoding/decoding according to a CELP codebook as claimed by the ’475 patent and as described at least in 3GPP standards document TS 26.445 §§ 4.4, 5.1 and 5.2.

149. For example, as recited in claim 1, the Apple iPhone 11 is a CELP codebook coding device for encoding sound into first, second, and third sets of encoding parameters, comprising: a first calculator of a first target signal for an

adaptive codebook search in response to an input sound signal; a CELP adaptive codebook stage structured to search, in response to the first target signal, an adaptive codebook to find an adaptive codebook index and an adaptive codebook gain, the adaptive codebook index and gain forming the first set of encoding parameters; a CELP innovative codebook stage structured to search, in response to a second target signal, a CELP innovative codebook to find an innovative codebook index and an innovative codebook gain, the innovative codebook index and gain forming the second set of encoding parameters; a transform-domain codebook stage structured to calculate, in response to a third target signal, transform-domain coefficients and a transform-domain codebook gain, the transform-domain coefficients and the transform-domain codebook gain forming the third set of encoding parameters; a second calculator of the second target signal and a third calculator of the third target signal; a selector of an order of the CELP innovative codebook stage and the transform-domain codebook stage as a function of at least one of (a) characteristics of the input sound signal and (b) a bit rate of a codec using the CELP codebook coding device, wherein the selector comprises switches having a first position where the CELP innovative codebook stage is first and followed by the transform-domain codebook stage and a second position where the transform-domain codebook stage is first and followed by the CELP innovative codebook stage, and wherein: in the first position of the switches, the second calculator determines the second target signal using the first target signal and information from the CELP adaptive codebook stage and the third calculator determines the third target signal using the second target signal and information from the CELP innovative codebook stage; and in the second position of the switches, the third calculator determines the third target signal using the first target signal and information from the CELP adaptive codebook stage and the second calculator determines the second target signal using the first target signal and

information from the CELP adaptive codebook stage and the transform-domain codebook stage, wherein each of the first calculator, the CELP adaptive codebook stage, the CELP innovative codebook stage, the transform-domain codebook stage, the second calculator, the third calculator, and the selector is configured to be processed by one or more processors, wherein the one or more processors is coupled to a memory. *See, e.g.*, TS 26.445 V14.2.0 §§ 4.4 and 5.2.

150. As recited in claim 3, the Apple iPhone 11 is also a device as defined in claim 1, wherein the selector comprises a classifier of the input sound signal, and the switches are controlled by the classifier to change the order of the CELP innovative codebook stage and the transform-domain codebook stage. *See, e.g.*, TS 26.445 V14.2.0 §§ 5.1 and 5.2.

151. Apple induces third parties, including consumers, to infringe the ’475 patent in violation of 35 U.S.C. § 271(b) by facilitating and encouraging them to perform actions that Apple knows to be acts of infringement of the ’475 patent, including at least claims 1 and 3. Upon information and belief, Apple knows that the use of its mobile devices, and other devices with EVS codec capabilities compliant with the EVS Standard, including Apple’s EVS Products, constitutes infringement of the ’475 patent. Apple advertises the infringing products and services, publishes specifications and promotional literature encouraging customers to operate the accused products and services, creates and/or distributes user manuals for the accused products and services that provide instruction and/or encourage infringing use, and offers support and/or technical assistance to its customers that provide instructions on and/or encourage infringing use.

152. For instance, Apple encourages and facilitates its customers to infringe the ’475 patent by instructing customers that purchase the Apple iPhone 11 that such devices have voice calling capability, and providing various indicators within those devices of the same. Apple also encourages and facilitates its

customers to infringe the ’475 patent by instructing customers that purchase the Apple iPhone 11 that such devices are compatible/operable on wireless carrier networks that support the EVS Standard. Apple’s customers, pursuant to Apple’s instructions and advertisements, each directly infringe the ’475 patent, including at least claims 1 and 3.

153. Apple’s infringement has caused and continues to cause damage to VoiceAge EVS, and VoiceAge EVS is entitled to recover damages sustained as a result of Apple’s wrongful acts in an amount subject to proof at trial.

COUNT V: INFRINGEMENT OF U.S. PATENT NO. 9,852,741

154. VoiceAge EVS incorporates by reference the foregoing paragraphs.

155. Pursuant to 35 U.S.C. § 282, the ’741 patent is presumed valid.

156. Upon information and belief, Apple has infringed, and is currently infringing, the ’741 patent in violation of 35 U.S.C. § 271(a) by making, using, offering to sell, selling, and/or importing into the United States without authority, products, equipment, software, and/or services, including Apple’s EVS Products, that practice one or more claims of the ’741 patent.

157. Apple infringes at least claims 17 and 20 of the ’741 patent because Apple’s EVS Products include hardware and/or software implementing the EVS codec compliant with the EVS Standard and are therefore capable of encoding sound signal as claimed by the ’741 patent and as described at least in 3GPP standards document TS 26.445 §§ 4.1, 4.4, 5.2, 5.4 and 5.5.

158. For example, as recited in claim 17, the Apple iPhone 11 is a device for encoding a sound signal, comprising: at least one processor; and a memory coupled to the processor and comprising non-transitory instructions that when executed cause the processor to: produce, in response to the sound signal, parameters for encoding the sound signal during successive sound signal processing frames, wherein (a) the sound signal encoding parameters include linear

predictive (LP) filter parameters, (b) for producing the LP filter parameters when switching from a first one of the frames using an internal sampling rate S**1** to a second one of the frames using an internal sampling rate S**2**, the processor is configured to convert the LP filter parameters from the first frame from the internal sampling rate S**1** to the internal sampling rate S**2**, and (c) for converting the LP filter parameters from the first frame, the processor is configured to: compute, at the internal sampling rate S**1**, a power spectrum of a LP synthesis filter using the LP filter parameters, modify the power spectrum of the LP synthesis filter to convert it from the internal sampling rate S**1** to the internal sampling rate S**2**, inverse transform the modified power spectrum of the LP synthesis filter to determine autocorrelations of the LP synthesis filter at the internal sampling rate S**2**, use the autocorrelations to compute the LP filter parameters at the internal sampling rate S**2**, and encode the sound signal encoding parameters into a bitstream; and wherein the processor is configured to: extend the power spectrum of the LP synthesis filter based on a ratio between S**1** and S**2** if S**1** is less than S**2**; and truncate the power spectrum of the LP synthesis filter based on the ratio between S**1** and S**2** if S**1** is larger than S**2**. *See, e.g.*, TS 26.445 V14.2.0 §§ 4.1, 4.4, 5.2, 5.4 and 5.5.

159. As recited in claim 20, the Apple iPhone 11 is also a device as recited in claim 17, wherein the processor is configured to compute the power spectrum of the LP synthesis filter as an energy of a frequency response of the LP synthesis filter. *See, e.g.*, TS 26.445 V14.2.0 § 5.5.

160. Apple induces third parties, including consumers, to infringe the ’741 patent in violation of 35 U.S.C. § 271(b) by facilitating and encouraging them to perform actions that Apple knows to be acts of infringement of the ’741 patent, including at least claims 17 and 20. Upon information and belief, Apple knows that the use of its mobile devices, and other devices with EVS codec capabilities

compliant with the EVS Standard, including Apple's EVS Products, constitutes infringement of the '741 patent. Apple advertises the infringing products and services, publishes specifications and promotional literature encouraging customers to operate the accused products and services, creates and/or distributes user manuals for the accused products and services that provide instruction and/or encourage infringing use, and offers support and/or technical assistance to its customers that provide instructions on and/or encourage infringing use.

161. For instance, Apple encourages and facilitates its customers to infringe the '741 patent by instructing customers that purchase the Apple iPhone 11 that such devices have voice calling capability, and providing various indicators within those devices of the same. Apple also encourages and facilitates its customers to infringe the '741 patent by instructing customers that purchase the Apple iPhone 11 that such devices are compatible/operable on wireless carrier networks that support the EVS Standard. Apple's customers, pursuant to Apple's instructions and advertisements, each directly infringe the '741 patent, including at least claims 17 and 20.

162. Apple's infringement has caused and continues to cause damage to VoiceAge EVS, and VoiceAge EVS is entitled to recover damages sustained as a result of Apple's wrongful acts in an amount subject to proof at trial.

JURY TRIAL DEMANDED

VoiceAge EVS hereby demands a trial by jury on all claims and issues so triable.

PRAYER FOR RELIEF

WHEREFORE, VoiceAge EVS respectfully requests that the Court:

A. Enter judgment that Apple has directly infringed one or more claims of one or more of the VoiceAge Patents, either literally or under the doctrine of equivalents, in violation of 35 U.S.C. § 271(a);

B. Enter judgment that Apple has induced infringement of one or more claims of the VoiceAge Patents in violation of 35 U.S.C. § 271(b);

C. Enter an order, pursuant to 35 U.S.C. § 284, awarding to VoiceAge EVS damages adequate to compensate for Apple's infringement of the VoiceAge Patents (and, if necessary, related accountings), in an amount to be determined at trial, but not less than a reasonable royalty;

D. Enter an order, pursuant to 35 U.S.C. § 285, deeming this to be an "exceptional case" and thereby awarding to VoiceAge EVS its reasonable attorneys' fees, costs, and expenses;

E. Enter an order that Apple account for and pay to VoiceAge EVS the damages to which VoiceAge EVS is entitled as a consequence of the infringement;

F. Enter an order for a post-judgment equitable accounting of damages for the period of infringement of the VoiceAge Patents following the period of damages established at trial;

G. Enter an order awarding to VoiceAge EVS pre- and post-judgment interest at the maximum rates allowable under the law and its costs; and

H. Enter an order awarding to VoiceAge EVS such other and further relief, whether at law or in equity, that this Court deems just and proper.

Dated: August 12, 2020

Respectfully submitted,

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